



WARREN



**PUMPING
MACHINERY**

WARREN STEAM PUMP COMPANY, INC. • WARREN, MASS.

• FOREWORD •

Warren specializes in the manufacture of fine pumps *exclusively*. It has consistently done so for the past 30 years.

The Warren policy is to design and build pumps that will insure their users the lowest possible pumping cost per year for the particular pumping job required. The Warren Centrifugal and Reciprocating Pumps described on the following pages are indicative of this policy.

Further, it is part of the Warren policy to "Build the Pump to Fit the Job." Should there be some pump size, capacity or condition which you seek particularly and which you fail to find mentioned in the following descriptions of standard Warren Pumps, this does not mean that the exceptional advantages of Warren Pumps must be denied your plant. For Warren is fully equipped, both by experience and facilities, to make special pump combinations, to design and build, whenever necessary, such special units as may deviate from standard practice—no matter how slight or how great that deviation might be.

Because Warren considers every pumping job as a separate engineering problem, Warren engineers are always available to you for studies and recommendations to meet your individual pumping needs . . . to insure your plant of the utmost efficiency and economy from every pumping installation. Feel free to call upon this Warren service at any time.

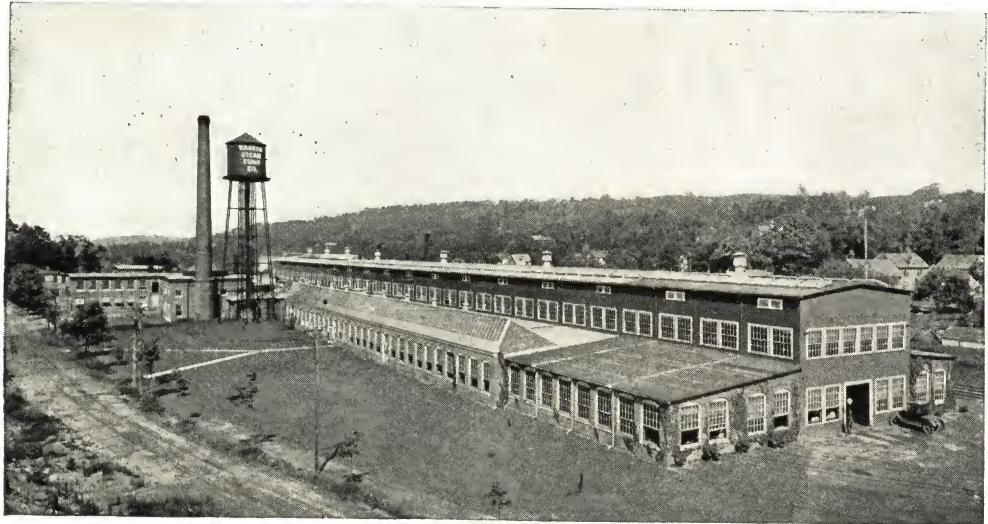
WARREN STEAM PUMP COMPANY, Inc.
WARREN, MASS.

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OFFICES AND AGENCIES

ATLANTA, GA.	Rittelmeyer & Co.
BOSTON, MASS.	Warren Steam Pump Company, Inc.
CHARLOTTE, N. C.	J. H. Trescot
CHICAGO, ILL.	Warren Steam Pump Company, Inc.
CINCINNATI, OHIO	Henry C. Hill
CLEVELAND, OHIO	H. W. Kaiser Co.
DETROIT, MICH.	Garrett Burgess, Inc.
HOUSTON, TEX.	The Tennant Company
LOS ANGELES, CAL.	Kimball-Krogh Pump Co.
NEW ORLEANS, LA.	Gulf Engineering Service & Specialty Co.
NEW YORK, N. Y.	Vincent-Gilson Engr. Co. (other than marine) Warren Engineering Corp. (marine only)
OKLAHOMA CITY, OKLA.	Ed. Trammell Pump & Machinery Co.
PHILADELPHIA, PA.	Warren Steam Pump Company, Inc.
PITTSBURGH, PA.	F. W. Smith
ST. LOUIS, MO.	Fred W. Ryder
ST. PAUL, MINN.	Robinson, Cary & Sands Co.
SAN FRANCISCO, CAL.	Western Engineering Co.
SCRANTON, PA.	The Whitmore Company
SEATTLE, WASH.	R. L. Dyer



• THE WARREN COMPANY • ITS HISTORY • • ITS EXPERIENCE • ITS FACILITIES •

The WARREN STEAM PUMP COMPANY, INC., of today had its beginning back in '97. An humble wooden building then housed the hopes, the ideals, the resources, the facilities of the new company. Reciprocating pumps were the sole products. But into the production of these went all the skill that the brains and brawn of the plant could muster. From the beginning—even as it is today—the company policy was to make no compromise with quality, but always to build and send forth on its mission a pump completely worthy of the name of Warren. To this end, constant research, incessant experimentation and development work were carried on.

The growth of the company's reputation for fine pumps and for fair dealings was rapid . . . and with it came an ever-increasing demand for Warren pumps. In 1924 the company went into the production of a complete line of centrifugal pumps as companion products to reciprocating pumps.

Naturally, expansion of plant and facilities became necessary as the scope of Warren pump distribution grew nation-wide. Replacement was made of all original buildings and equipment with those of the most modern construction and advantages. The main shop alone is 540 ft. long and is served by two giant electric traveling cranes. Facilities for manufacturing Warren Pumps, standard or special, are modern and fully adequate for every need. Obsolescent machinery, tools and methods have no place in the Warren plant to hinder production, heighten costs or hazard quality. Testing equipment, for example, includes three large tanks. The largest, 80 ft. long by 30 ft. wide, contains 110,000 gals. of water and has been used to test pumps with capacities up to 29,000 gals. per minute.

As it has done for hundreds of others, a Warren proposal will definitely demonstrate the worth of Warren history, experience and facilities as applied to *your* present or future pumping needs.



All Warren Pumps are guaranteed against defects in either material or workmanship for a period of one year from date of shipment. Any part proving defective from either cause in that time will be replaced without charge, f.o.b. our Works, provided the purchaser gives us immediate notice in writing of such defect and will deliver to our Works, transportation charges pre-paid, the defective part or parts.

WARREN MULTI-STAGE BALANCED TYPE CENTRIFUGAL PUMPS

Warren Multi-Stage Centrifugal Pumps typify the results of Warren engineering ability, manufacturing skill and experience in building pumps that combine high efficiency, lasting dependability and minimum maintenance.

All parts are of the finest, extra heavy materials and the quality of workmanship is in complete keeping with Warren standards. Each Warren Multi-Stage Pump of the opposed impeller type is hydraulically balanced, which means that the design and arrangement of the impellers is such that end thrust is reduced to a minimum. (See Fig. 1.)

Note that the high pressure stuffing box has to be packed against the pressure of the first stage only. Other multi-stage pumps are balanced by the use of a balancing drum. (See Fig. 2.)

Quick, easy accessibility to all interior parts is possible without disturbing piping connections. Easily replaceable protecting pieces are provided for all parts subject to wear. There is but one joint in the casing.

Available for a wide range of uses and, where necessary, built to fit the job, all Warren Multi-Stage Pumps can be arranged for belt drive, or direct connection to motor or turbine.

SPECIFICATIONS

Pump Casing

Of the volute type, correctly proportioned with easy curvature and liberal area.

Made of cast iron, casing consists of two parts, separated on horizontal plane.

Lower half contains both suction and discharge openings.

Top half, or case cover, readily raised for inspection of impellers and all interior parts.

Removal of bearing caps and case cover permits the rotating member to be removed without disturbing piping connections or other parts.

Impellers

Of the enclosed type, and made of special high grade bronze.

The outside surface is carefully machine-finished, with interior passages chipped and filed for smoothness.

Accurately fitted and keyed to shaft and firmly secured by lock nuts which form part of shaft sleeves.

Protecting Rings

Pump casing and impellers provided with removable protecting rings. On the casing, these rings are securely held in place by tongue and groove joints; on impellers, by right and left hand threads. In smaller sizes of pumps, up to and including the 3-inch size, removable rings are not furnished on impellers.

Bearings

Cast iron, of the bracket type, and bolted securely to the bottom half of pump casing. Brackets provided with removable covers and fitted with removable cast iron split shell, genuine babbit lined, ring oiling bushings. Multi-collar marine type thrust bearing, supporting bracket of which is provided with jacket for water-cooling the lubricant. Water-cooled thrust bearing of the ball type or Kingsbury thrust bearings can be furnished.

Shaft

Of high carbon, open-hearth steel turned straight and true throughout its entire length and finished by grinding on dead centers, thus insuring perfect alignment, accurate dimensions and high finish. Shaft is of ample diameter to transmit required power safely without undue bending or twisting.

Shaft Sleeves

To protect shaft from corrosion and wear, bronze sleeves are provided and extend through stuffing boxes.

Packing Glands

Of split type and easily accessible. Can be removed without disturbing other parts. Stuffing boxes are extra deep, arranged for metallic or soft packing, and provided with water seals, all necessary drip boxes and drainage openings.

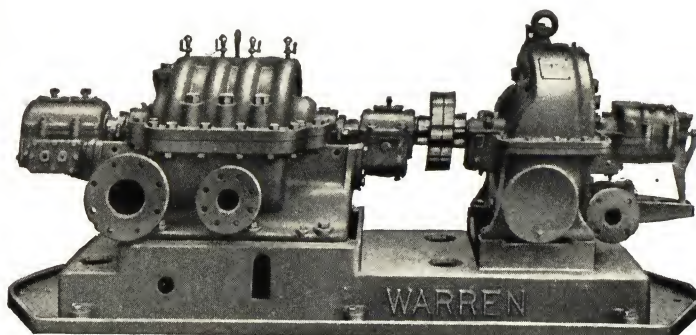


Fig. 241—Warren Four-Stage Balanced Type Centrifugal Pump with Turbine Drive

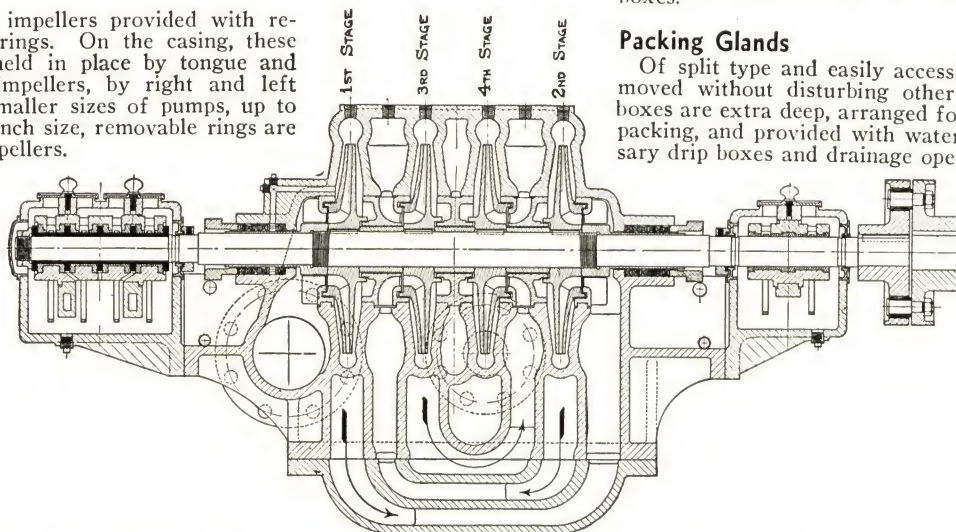


Fig. 1—Cross Section Diagram of 4-Stage Pump, Showing Arrangement of Water Passages to Reduce End Thrust

Base Plate

Of the box type and one-piece cast iron construction. Provided with faced pads for mounting pump and prime mover.

Coupling

Made of cast iron or steel, of the flexible, steel pin, rubber buffer type or other approved equal.

Equipment, Painting, Etc.

Eyebolts for lifting pump case cover, and special wrenches required for removal of certain pump parts are regularly furnished. Before shipment, exterior surfaces of pump and base plate are given two coats of filler, rubbed smooth and finished with one coat of machinery paint.

Note: In writing to us, your interests will be best served if information of the type listed on page 5 is given.

Testing

Each pump is put through a running test to verify performance guarantees. Customers are welcomed as witnesses to this test. Casing is subjected to hydrostatic test pressure of *at least* 50% in excess of maximum working pressure—a test that will readily reveal the slightest sign of leakage or weakness.

Engineering Service

Warren engineers are ready to co-operate with you to the fullest extent in order to ensure you of getting the right pump for the job at hand. A proposal by Warren is a guarantee—never a compromise—that the pump will meet the customer's individual requirements.

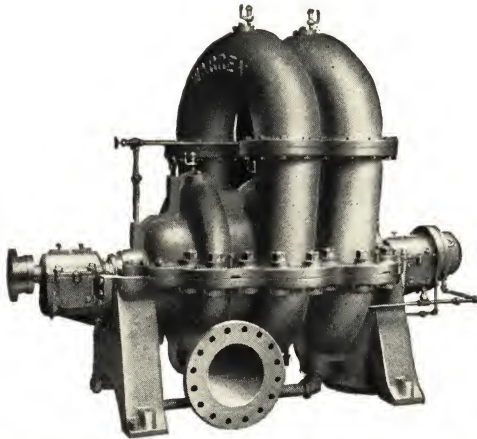


Fig. 325—12-Inch, 3-Stage Balanced Type Centrifugal Pump

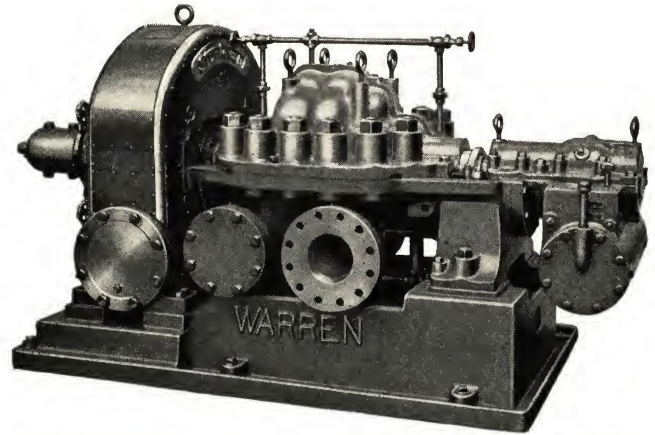


Fig. 319—5-Inch, 3-Stage, Close Coupled, Turbine-Driven, Balanced Type Centrifugal Pump

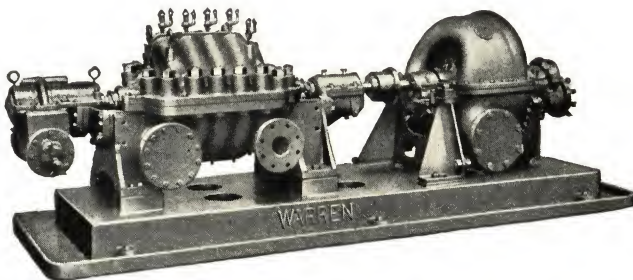


Fig. 285—4-Inch, 5-Stage Centrifugal Feed Pump

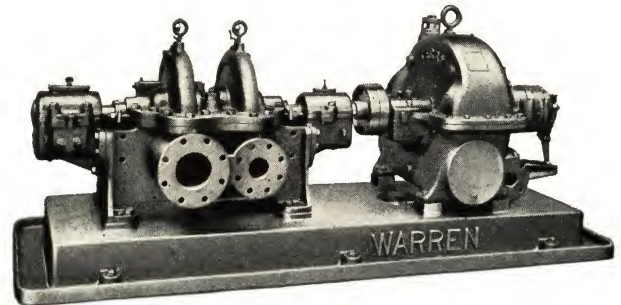


Fig. 248—3-Inch, 2-Stage Double Suction Centrifugal Pump

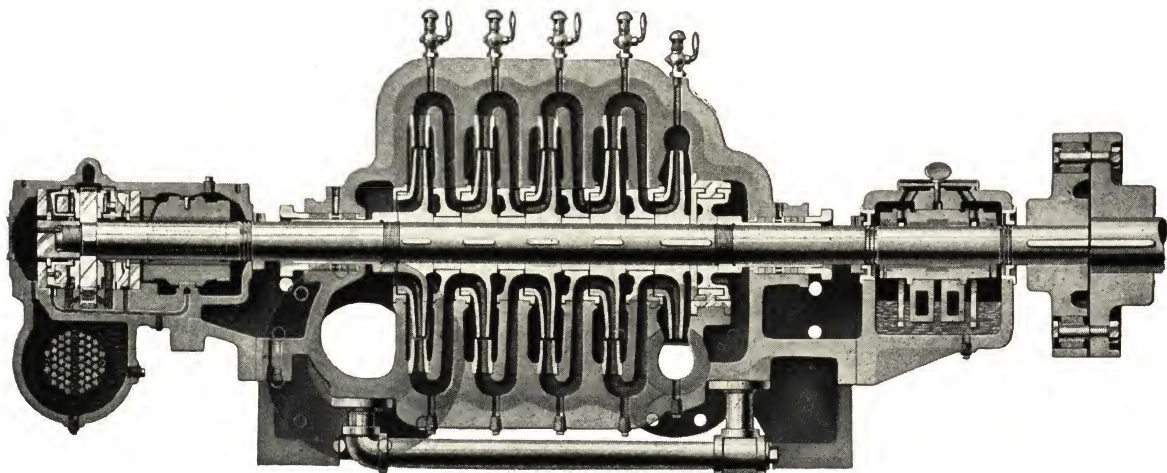


Fig. 2—Sectional View of a Warren 4-Inch, 5-Stage Boiler Feed Pump

WARREN SINGLE-STAGE DOUBLE-SUCTION CENTRIFUGAL PUMPS

These pumps, like all Warren pumps, are designed and built upon sound engineering principles. As such, you may be sure that those essentials of completely satisfactory service—efficiency, dependability, minimum maintenance, slow depreciation, and lowest possible pumping cost per year for the pumping job required—have been built into these pumps in as great a measure as possible. *How great*, may be readily determined by careful consideration of Warren Single-Stage, Double-Suction

Centrifugal Pumps. They include those all-important mechanical factors upon which a careful selection of centrifugal pumps should be based.

We ask that you study these points . . . realize their true significance . . . compare them point by point with pumps of a similar nature . . . and thus find conclusive proof that in the design and construction of the Warren pump there is never a compromise on quality, but always a guarantee of the service, the satisfaction, the security, you seek.

IMPORTANT FEATURES AND GENERAL CONSTRUCTION

Bearing Seal

A good bearing seal should prevent escape of oil and entrance of water to bearing, as well as keep out dirt and dust. In the Warren pump, tapered grooves in the shaft throw the oil back towards the reservoir. A slinger fastened to the shaft and fitted over a projection on the end cover effectively stops the travel of water into the reservoir.

Oil Reservoir

The oil reservoirs on Warren Centrifugal Pumps are extra large and, in connection with the effective oil seal, make frequent oilings unnecessary.

Shaft

It is important to note the size of the shaft at impeller and bearings. The shafts in Warren Centrifugal Pumps are extra large, preventing vibration and deflection. Warren shafts are made of open hearth high carbon steel with a tensile strength of 90,000/110,000 lbs. per sq. in.

Impellers and Sleeves

All impellers and sleeves for Warren pumps are of heavy design, and cast from the highest grade of bronze.

Weight

You want the weight in the pump where the work is performed, and not in the baseplate. Warren pumps have heavy bronze impellers and thick iron casings.

Thrust Collars

The thrust collars for all Warren pumps are designed with a very liberal carrying capacity. They are shouldered and keyed to the shaft and securely held in place by a flanged lock nut.

Bearings

Long split bearings of large diameter such as are in Warren Centrifugal Pumps, reduce the load per square inch of bearing surface, prevent bearing troubles and have unusually long life.

Glands

The glands of Warren Pumps are made of bronze, split, with halves bolted together. Their heavy construction prevents bending of the ears.

Clearances

The clearance between impeller rings and case rings in Warren Centrifugal Pumps is liberal, ranging from .015 in. to .030 in. This means that Warren Pumps do not obtain their efficiencies by close clearances, only to lose them after the pump has been in operation a short time. Many pumps rely upon close clearances to obtain their high shop test efficiencies, but rapid wear on the rings causes a noticeable drop in efficiency shortly after the pumps are put in service. Warren Pumps, with liberal clearances, maintain their original efficiencies over long periods.

General Construction

Warren Centrifugal Pumps are designed to permit disassembly and inspection of all parts without disturbing suction or discharge pipe connections. Top half or pump case cover is easily raised, rendering impeller and all interior parts accessible. By removing bearing caps, rotating member may be lifted out without disturbing pipe connections or other parts of machine. Pump can be readily taken apart and assembled by unskilled attendants without use of special tools.

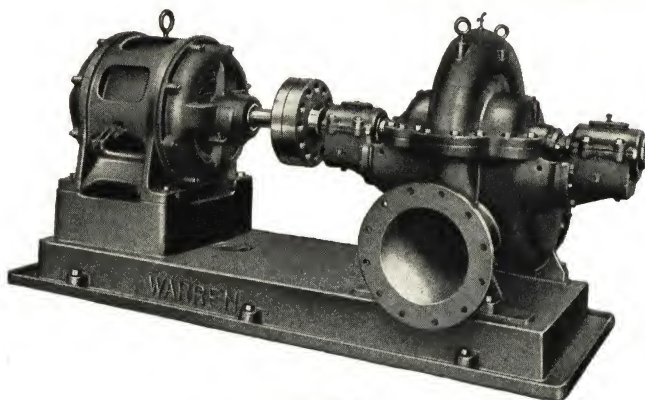


Fig. 249
14-Inch, Single-Stage Double-Suction Pump

Long life and the maintenance of maximum efficiency with minimum expense for repairs are insured by providing parts subjected to wear with easily replaceable protecting pieces, which are all manufactured on limit gauge, interchangeable basis.

Warren Single-Stage, Double-Suction Centrifugal Pumps are built for speeds up to 3600 r.p.m. Each pump must pass exacting performance tests before shipment. Performance guarantees are verified by these tests and the customer is cordially invited to witness them.

For a Warren Recommendation . . .

Get in touch with a Warren Agent or write us. Your interests may best be served if care is taken to give us full information on such pertinent points as:

1. Kind of liquid to be pumped (and whether hot or cold, clear or gritty).
2. Height to which liquid will be lifted by suction; length and diameter of suction pipe and number of elbows.
3. Height, or against what pressure, liquid will be pumped; length and diameter of discharge pipe and number of elbows.
4. Maximum number of gallons to be pumped, per minute or hour.
5. Type of prime mover (belt, motor or turbine). If turbine or steam engine, give us steam pressure, etc. If electric motor give current characteristics.

. . . **and remember**, that a Warren recommendation is *never* a compromise, *always* a guarantee that a Warren Pump will do the job at the lowest possible pumping cost per year for the particular pumping job required.

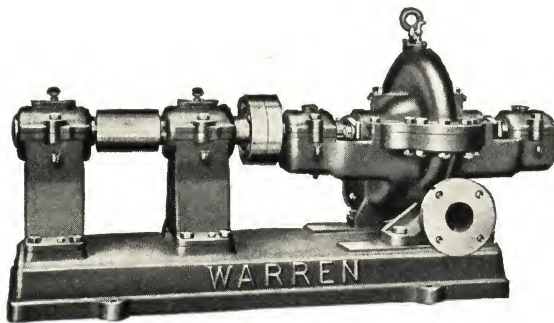


Fig. 233
3-Inch, Single-Stage Double-Suction, Belt Drive

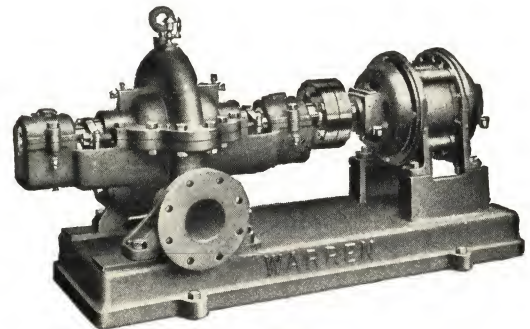


Fig. 225
4-Inch, Single-Stage, Double-Suction, Motor Drive

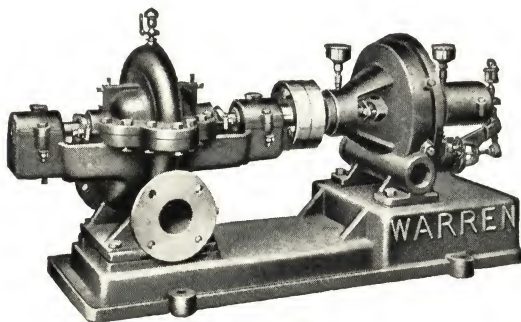
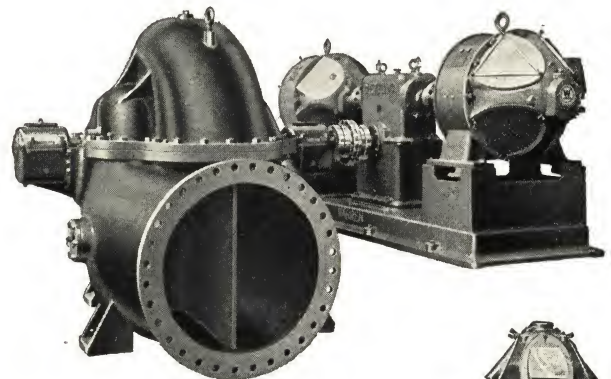


Fig. 226
3-Inch, Single-Stage, Double-Suction, Turbine Drive



Above:

Fig. 312—30-Inch, Single-Stage, Double-Suction Pump, Motor Driven Through Reduction Gears

Right:

Fig. 323—2-Inch, Vertical, Single-Stage Condensate Pump

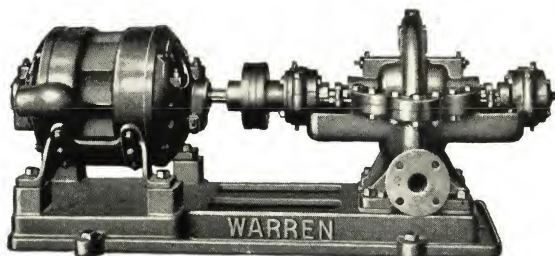
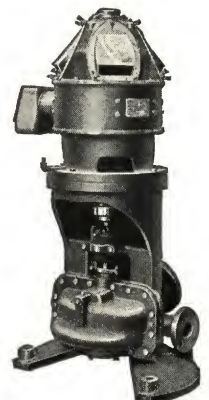


Fig. 255
1½-Inch, Single-Stage, Double-Suction, Motor Drive



WARREN SINGLE-STAGE CENTRIFUGAL STOCK PUMPS

For Handling Pulped Stocks in the Paper Mill Industries . . .

Nowhere is the demand for modern, dependable, efficient pumps greater than in the paper manufacturing industry. Progress in this field has demanded the handling of higher consistency stocks, greater capacities, higher efficiencies and freedom from shut-downs. Warren Centrifugal Stock Pumps have been notably successful in meeting these demands.

Since the initial installation in 1924, the superiority of Warren Stock Pumps in handling pulp and paper mill requirements has been popularly con-

ceded. Proof that Warren design and construction have met with the unqualified approval of paper mill authorities . . . proof that in actual operation the pumps are living up to efficiency and economy claims . . . is reflected in the continual adoption of Warren Stock Pumps by concerns that are satisfied with nothing but the best. Perhaps no stronger evidence need be offered than the fact that *70% of the purchasers of Warren Centrifugal Stock Pumps have placed repeat orders, and others have stated their intentions of so doing!*

EACH INSTALLATION CONSIDERED A SEPARATE ENGINEERING PROBLEM

The recent progress in paper mill practice has meant much pioneer work in stock pump design, and it is acknowledged that many of the stock handling problems cannot be met by the use of standardized stock pumps. That is why it is the policy of the Warren Company to consider each stock pump job as a separate engineering problem . . . to treat each installation as a distinctly separate and individual job . . . to take all factors into consideration . . . and then make recommenda-

tions only on the basis of the correct pump for the job.

The extensive experience of our Engineering Department in pulp and paper mill pump installations becomes especially valuable to those considering new methods or new equipment. Warren Engineers are immediately available to assist in working out a satisfactory solution to any pumping problem and will gladly prepare recommendations for your particular requirements on request.

GENERAL DESCRIPTION

Design

Warren Centrifugal Stock Pumps are successful because back of them is correct design. Warren design is the result of actual studies and field experiments in handling stocks of various kinds and consistencies in many paper mills.

It is fundamental that if the maximum of successful operation is to be obtained, the design of one part must bear the proper relation to the design of another. In a pump, this means that both hydraulic and mechanical details must be carefully analyzed. The velocity of the liquid must be kept, at all times, within such bounds as

experience has shown to give the best results, and all parts must be proportioned to stand up under the severe service encountered in pulp and paper mill practice.

To fully appreciate Warren design, examine the sectional view of the pump at the top of the following page.

Note the extra heavy, non-vibrating, non-deflecting shaft . . . the heavy bearings mounted in a substantial unit pedestal that insures perfect alignment . . . the easily *renewable* liners . . . the liberal stuffing boxes . . . the distinctly Warren design of impeller. These are the fine points, the distinguishing features that re-

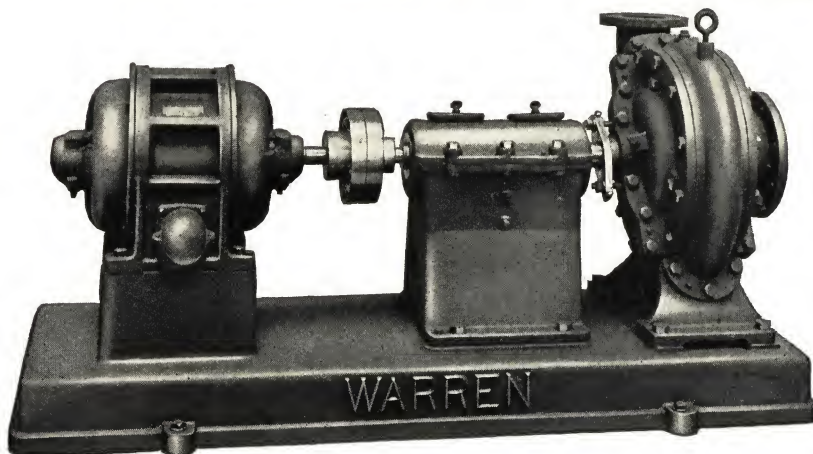


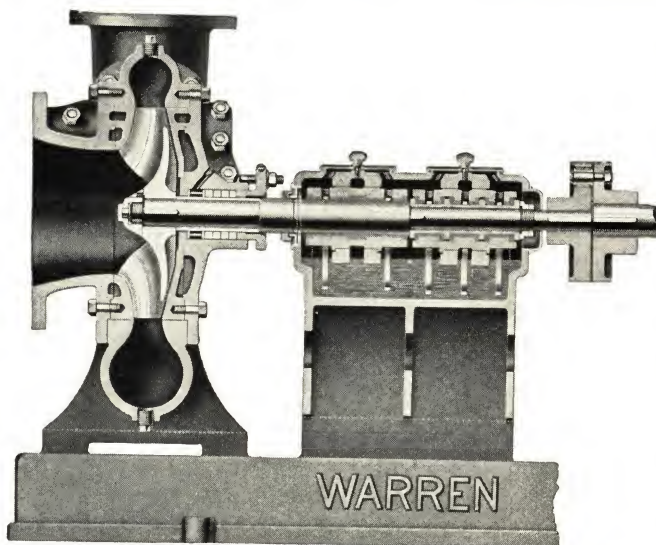
Fig. 228—5-Inch, Single-Stage Stock Pump

veal why Warren Stock Pumps will handle 6% stock smoothly, efficiently, without clogging or binding . . . why, for example, in an Eastern Mill, a Warren Pump economically fills a 1400-lb. beater with 5% kraft stock in 1 minute and 20 seconds!

Impellers

Wide Variety Available—The impeller is the heart of the pump. Consequently, to the design and operation of the Warren Impeller has been brought all the wide and varied experience of Warren Engineers in handling solids in suspension. Warren Impellers are not limited to a standardized line, nor to any fixed number of blades. Research and experiment revealed that a wide and varied line of impellers was necessary because operating conditions may require an impeller of different design from that in a pump handling identical stock, but under different conditions.

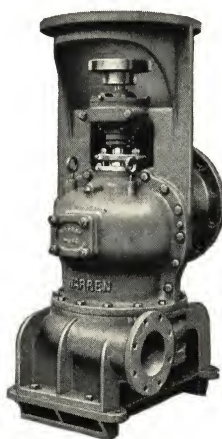
Self-Cleaning and Non-Binding—Shut-downs due to clogging . . . caused by stock working back of pump impellers, there to pack tight and bind the pump . . . have been eliminated because of Warren Impellers. Warren Engineers, after several years of experimentation work and testing, have so designed Warren Impellers as to make them self-cleaning and non-binding . . . an invaluable time, trouble and cost-saving feature. Used in mills where stock handling conditions are severe, Warren Stock Pumps equipped with the new type of impeller are giving uninterrupted service day in and day



Sectional View of Warren Centrifugal Stock Pump Arranged for Direct Drive

ness of design. One without the other would be worthless.

To ensure the efficiency of the pump throughout, all materials are of first quality and carefully selected. Both materials and workmanship are subjected to rigid inspection and tests.



Special Warren Vertical Stock Pump

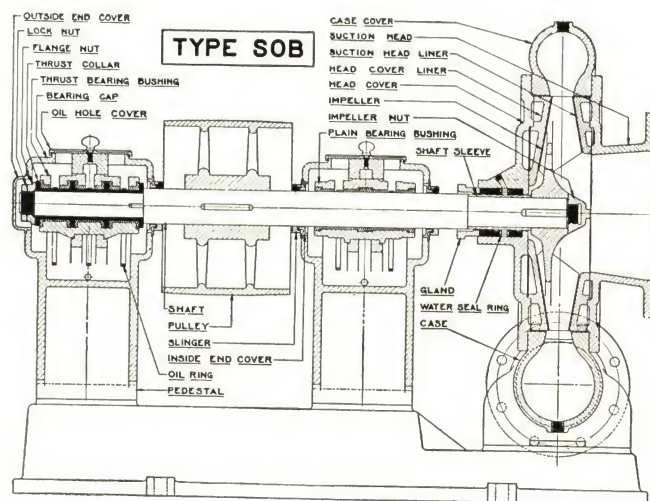
Special Warren Vertical Stock Pump

This pump will handle heavy or thin stocks, low, medium or high head service. Intended primarily for installations where the suction submergence is low. Large top suction eliminates air-binding.

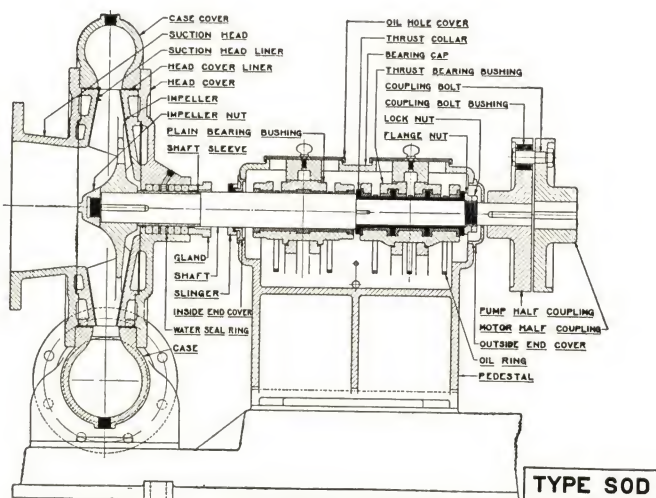
For conditions where the suction pipe may be uncovered, we usually recommend this pump.

With a vertical pump, it does not matter whether the suction pipe is uncovered or not, for as long as the stock flows onto the impeller, it will discharge same.

Note: Stock friction tables will be gladly sent on request to interested parties.



Type SOB—Belt Driven Centrifugal Stock Pump



Type SOD—Direct Connection Centrifugal Stock Pump

WARREN STEAM HEAT VACUUM PUMPS

The Warren line of Steam Heat Vacuum Pumps is a further example of the Warren policy of designing, building and testing its pumps to insure complete dependability, maximum operating efficiency and minimum maintenance over the longest possible period. The design has stood the test of time and stress of service. Their widespread use on various heating systems reflects their ability to give the long, efficient, trouble-free service that pumps of this nature should be built to give.

Designed to maintain a vacuum in and drain steam coils, radiators, etc., on heating and drying systems, Warren Vacuum Pumps insure positive circulation of the steam throughout the system and relieve back pressure on the engine or other apparatus from which the exhaust steam is utilized, discharging the drainage into a tank or heater. Because they insure the vaporization of the steam until it is reduced to a temperature below that of

the vacuum, these pumps, applied to a heating system, definitely insure a notable increase in the efficiency of the exhaust steam.

Warren Steam Heat Vacuum Pumps are designed to operate on ordinary steam pressures. The capacity ratings given in the tables below are intended to represent the amount of radiating surface that these pumps will serve when running at a conservative piston speed, under ordinary conditions of installation and service. Where conditions are unusual, we would recommend that before determining upon any of the sizes listed in the tables below, we be advised regarding the existing conditions under which the pump would be required to operate. Further, Warren Engineers will gladly co-operate with you in working out the most economical solution to the pumping problem at hand.

Note: Cast iron pans for use with Warren Vacuum Pumps can be furnished, if desired, at small additional cost.

SPECIFICATIONS

Valve Motion—Obtained by use of the Warren "Eclipse" patented valve gear.

Steam Piston—Of the snap ring type.

Water Cylinder, Valve Chest, Cover, and Cylinder Head—Made of cast iron.

Water Cylinder Lining—Made of heavy seamless brass tube or rolled sheet.

Water Piston—Made of cast iron, of the non-adjustable type, with bronze stud and nuts. Bronze piston furnished at slight extra cost.

Valve Seats, Stems, Guards, Nuts and Springs—Made of bronze.

Valves—Made of phosphor bronze of multi-disc type.

Piston Rod—Made of sturdy rolled bronze.

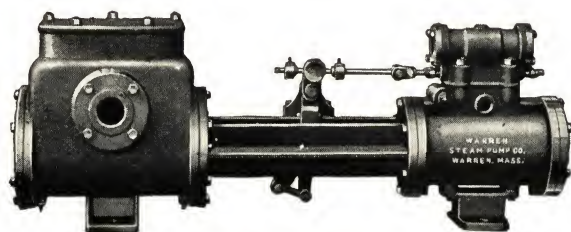


Fig. 174—Size 8x10x12

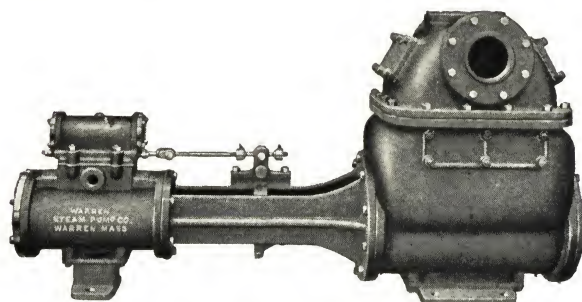


Fig. 158—Size 10x16x18

DIMENSIONS OF PUMP TYPES INDICATED BY FIG. 174

Size	Steam	Exhaust	Suction	Discharge	Sq. ft. direct heating surface drained	Piston speed ft. per min.	Single strokes per min.	Code word
4 x 5 x 5	1/2	3/4	2	1 1/2	4,760	34	82	Vacone
4 x 6 x 7	1/2	3/4	2 1/2	2	8,070	40	69	Vactwo
5 1/2 x 8 x 7	3/4	1	3	2 1/2	14,300	40	69	Vacthree
6 x 8 x 12	3/4	1	3 1/2	3	19,210	54	54	Vacfour
6 x 10 x 12	3/4	1	4	3 1/2	30,040	54	54	Vacsix
8 x 10 x 12	1	1 1/4	4	3 1/2	30,040	54	54	Vacare
8 x 12 x 12	1	1 1/4	5	4	43,200	54	54	Vacall
10 x 14 x 12	1 1/4	1 1/2	6	5	58,900	54	54	Vaccur

DIMENSIONS OF PUMP TYPES INDICATED BY FIG. 158

10 x 14 x 18	1 1/4	1 1/2	8	6	88,300	81	54	Vacaa
10 x 16 x 18	1 1/4	1 1/2	8	6	115,300	81	54	Vacab
12 x 18 x 18	2	2 1/2	8	8	145,000	81	54	Vacac
12 x 18 x 24	2	2 1/2	8	8	160,000	90	45	Vacad
14 x 20 x 24	2	2 1/2	9	8	201,000	90	45	Vacae

WARREN HORIZONTAL SINGLE PISTON PUMPS

For Boiler Feed or Pressure Service . . . Tank or Light Pressure

Similar in purpose to the Warren Vertical Single Piston Pumps described on the following page, but recommended where space limitations are not a deciding factor. Warren Horizontal Single Piston Pumps are made in a variety of sizes and types and are adaptable to a wide range of services and operating conditions.

Their wide acceptance and record for "repeat" orders can be traced not only to their dependability and durability in service, but also to their insurance of a maximum of pumping service at a minimum pumping cost per year. Back of these features, of course, are the sound design, quality materials and skilled workmanship which, as the Warren standard, enter into these pumps and provide the strength and rigidity that preserves alignment no

matter how great the stress and strain of operating conditions.

As in the construction of the Vertical Single Piston Pumps, every pump of the Horizontal class is fitted with the patented Warren "Eclipse" Valve Gear, which, as described on the following page, effects considerable economy in steam consumption and, by causing the pump to slow down gradually, saves wear and tear on valves in their seating operation.

As regularly furnished, these pumps are equipped with brass liners in the pump cylinders, as well as brass pump pistons, valve seats and valve fittings. Valves can be furnished of either hard or medium rubber, as preferred.

Can be built to operate on super-heated steam.

FOR BOILER FEED OR PRESSURE SERVICE

Size, inches			Gals. per stroke	Max. capacity per min.			H.P. boiler pump will feed at slow speed, 34.5 lbs. per H. P. H.	Code word
Steam cylinder	Water cylinder	Stroke		No. single strokes	Ft. piston speed	Gallons		
4	2½	5	.10	58	24	5.8	84	Keating
5½	3¾	7	.33	44	26	14.5	210	Knight
7	4	7	.38	44	26	16.7	242	Knightly
7	4½	10	.69	46	38	31.74	460	Keen
7½	5	10	.85	46	38	39.1	566	Keenly
8	5	12	1.02	40	40	40.8	591	Katzer
10	6	12	1.47	40	40	58.8	852	Keep
12	7	12	2.00	40	40	80.0	1,160	Keepwell
14	8	12	2.61	40	40	104.4	1,513	Keepsake
16	10	16	5.44	38	50	206.7	2,996	Kaffir
18	12	24	11.75	32	64	376.0	5,450	Konite

FOR TANK OR LIGHT PRESSURE SERVICE

4	4	5	.27	82	34	22.14	.....	Kid
5½	5½	7	.72	69	40	49.68	.....	Kiddest
6	6	12	1.47	54	54	79.38	.....	Kettle
7	7	12	2.00	54	54	108.0	.....	Kentif
7½	7½	10	1.91	62	52	118.42	.....	Kidwell
8	8	12	2.61	54	54	140.94	.....	Kerchief
8	10	12	4.08	54	54	220.32	.....	Keyhole
10	10	12	4.08	54	54	220.32	.....	Kangaroo
10	12	12	5.87	54	54	316.98	.....	Kidnap
10	12	18	8.81	54	81	475.74	.....	Killer
12	12	12	5.87	54	54	316.98	.....	King
12	12	18	8.81	54	81	475.74	.....	Kingfish
12	14	12	8.00	54	54	432.0	.....	Kink
12	14	18	12.00	54	81	648.0	.....	Kingworth
14	14	12	8.00	54	54	432.0	.....	Kip
14	14	18	12.00	54	81	648.0	.....	Kipper
14	16	18	15.66	54	81	845.64	.....	Knobby
14	18	18	18.83	54	81	1,016.82	.....	Knob
14	18	24	26.44	45	90	1,190.0	.....	Kag
16	18	24	26.44	45	90	1,190.0	.....	Kagger

Essential Information Needed for Proposals . . .

The Warren Engineering Department is always glad to serve in an advisory capacity to those having pumping problems of an unusual or difficult nature. In writing to us, your interests will be better served if full information is given on such points as the following:

1. Kind of liquid to be pumped and whether hot or cold, clear or gritty.
2. Height to which liquid will be lifted by suction; length and diameter of suction pipe and number of elbows.
3. Height, or against what pressure, liquid will be pumped; length and diameter of discharge pipe and number of elbows.
4. Maximum number of gallons to be pumped per minute or per hour; or boiler horsepower to be fed.
5. Lowest steam pressure available at pump.
6. Will steam exhaust into atmosphere, into a condenser, or against back pressure? If the last, how much?

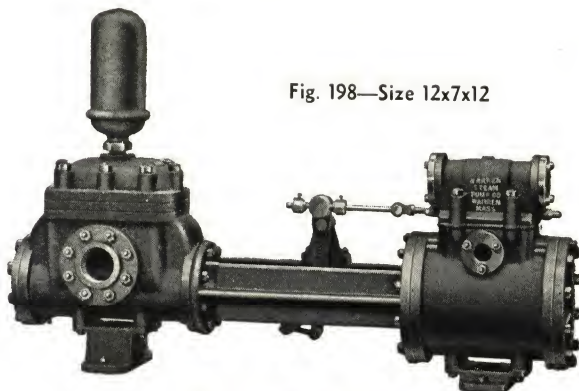


Fig. 198—Size 12x7x12

Cast-centerpiece Type

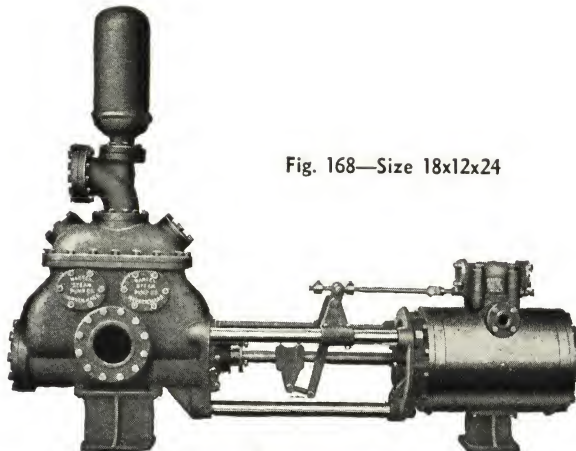


Fig. 168—Size 18x12x24

Tie-rod Centerpiece Type

WARREN VERTICAL SINGLE PISTON PUMPS

For Boiler Feed or Pressure Service . . . Tank or Light Pressure

Available for the services and in the sizes noted in the tables below, Warren Vertical Single Piston Pumps are a logical choice wherever economy of steam consumption and space restrictions are factors to be taken into consideration. Designed primarily for marine or naval service, their performance records have led to their adoption in increasing number by engineers for stationary installations as well.

In their design and construction, nothing has been left undone to insure a sturdy, exceptionally efficient and economical line of pumps. The pistons move in a vertical plane, thus providing for equal wear on all surfaces of the cylinder walls . . . a feature to be considered in comparison with some horizontal pumps in which the weight of the pistons tends to cause wear on the lower side of the cylinder wall only.

An especially desirable feature is that all pumps of this type are fitted with the patented Warren

"Eclipse" Valve Gear. Among the advantages of this valve gear is that it cuts off the steam toward the latter part of the stroke, at which time the requirements for steam are not as great as at reversal.

This allows the pump to utilize the vast expansive force of the steam, and serves also to allow the pump to slow down gradually and thus permit the valves to seat easily and without shock.

Piston rods in pumps having strokes of 6 in. and shorter are of the one-piece type and made of rolled bronze. In all other pumps, of the two-piece type, the steam end rod is made of steel and the pump end rod of rolled bronze.

Pump ends are lined with brass, and valve seats and valve fittings are also of brass. For marine and special service, pump ends can be furnished made entirely of bronze.

Can be built to operate on super-heated steam.

FOR BOILER FEED OR PRESSURE SERVICE

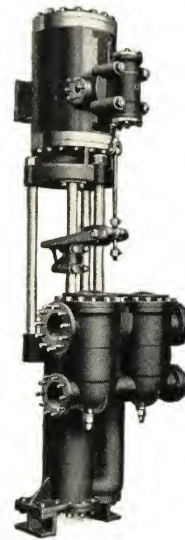
Size			Capacity				Boiler H.P. will feed	Code word
Steam cylinder	Pump cylinder	Stroke	Gals. per stroke	Strokes per min.	Ft. piston speed	Total G. P. M.		
3½	2¼	4	.07	66	22	4.62	67	Wad
4½	2½	6	.13	52	26	6.76	98	Wafer
5½	3½	6	.25	52	26	13.0	188	Waft
6	4	8	.43	45	30	19.35	280	Wag
8	5	12	1.02	40	40	40.8	591	Weak
9	6	12	1.47	40	40	58.8	852	Weal
10	6	12	1.47	40	40	58.8	852	Wealthy
10	7	12	2.00	40	40	80.0	1,160	Wear
12	7	12	2.00	40	40	80.0	1,160	Wearily
12	8	12	2.61	40	40	104.4	1,513.	Weasel

Long Stroke Type

6½	4½	12	.82	40	40	32.8	475	Wicked
9	6	16	1.96	38	50	74.5	1,078	Wide
10	6	18	2.19	40	60	88.1	1,278	Widel
10	6	24	2.94	32	64	94.0	1,362	Widely
10	7	18	2.99	40	60	119.6	1,734	Wife
10	7	24	4.00	32	64	128.0	1,855	Wifely
12	8	18	3.92	40	60	158.8	2,272	Wild
12	8	24	5.22	32	64	167.0	2,420	Wildcat
13	9	16	4.41	38	50	167.6	2,430	Wince
14	9	24	6.61	32	64	211.5	3,065	Windage
14	10	24	8.16	32	64	261.2	3,785	Window
15	10	16	5.44	38	50	206.7	2,995	Wire
15	10	24	8.16	32	64	261.2	3,785	Wireless
16	10½	24	8.99	32	64	287.7	4,170	Wiry
16	12	24	11.75	32	64	376.0	5,450	Wisdom

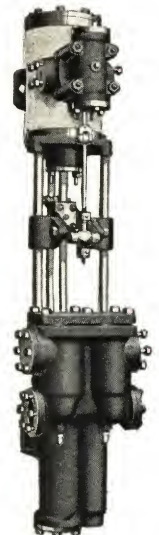
FOR TANK OR LIGHT PRESSURE SERVICE

3½	4	4	.22	90	30	19.8	.....	Woe
4½	5	6	.51	80	40	40.8	.....	Wolfish
4½	6	6	.73	80	40	58.4	.....	Wolver
6	6	12	1.47	54	54	79.4	.....	Wood
6	7	8	1.33	64	43	85.1	.....	Wonder
6	7	12	2.00	54	54	108.0	.....	Wool
7	7	12	2.00	54	54	108.0	.....	Woolen
6	8	8	1.74	64	43	93.6	.....	Wont
6	8	12	2.61	54	54	140.9	.....	Word
7	8	12	2.61	54	54	140.9	.....	Worried
6	9	12	3.31	54	54	178.8	.....	Wore
8	9	12	3.31	54	54	178.8	.....	Work
6	10	12	4.08	54	54	220.3	.....	World
8	10	12	4.08	54	54	220.3	.....	Worldly
8	10	24	8.16	45	90	440.6	.....	Worm
10	12	12	5.88	54	54	317.5	.....	Worship
12	14	12	8.00	54	54	432.0	.....	Worthless
12	14	24	16.00	45	90	720.0	.....	Would
14	16	16	13.9	50	68	696.0	.....	Woven



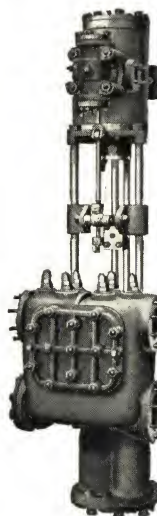
Left:

Fig. 161
Size 16x12x24
Valve Pot Type



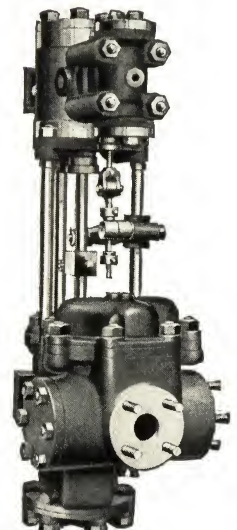
Right:

Fig. 179
Size 6½x4½x12
Valve Pot Type



Left:

Fig. 180
Size 6x8x12
Mono-chest
Type



Right:

Fig. 145
Size 3½x4x4
Cap and Plate
Type

WARREN HORIZONTAL DUPLEX PISTON PUMPS

For Boiler Feed or Pressure Service . . . Light Heads or Low Service

Where the duplex type of piston pump is preferred and space permits use of the horizontal type, Warren Horizontal Duplex Piston Pumps are as much the logical choice for your plant as they have been for hundreds of other purchasers whose determination was to insure "lowest possible pumping cost per year." Except for the difference in verti-

cal and horizontal design, these pumps are identical in construction throughout as the vertical pumps described on the succeeding page. The complete range of sizes is given in the tables below.

Note: When writing for information, please give data as outlined on page 9 under the heading, "Essential Information Required."

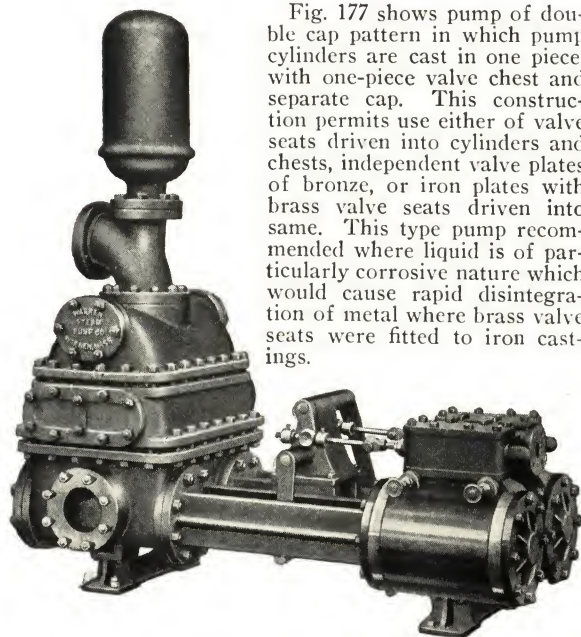


Fig. 177—Size 10x7x12

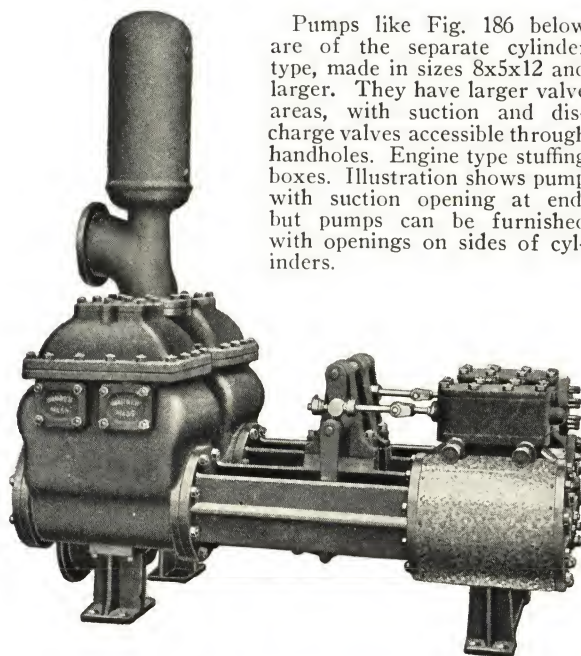


Fig. 186—Size 14x10x12

FOR BOILER FEED OR PRESSURE SERVICE

Size			Capacity				Boiler H.P. based on 34.5 lbs. per H.P.H.	Code word
Diameter		Stroke	Gals. per stroke each piston	Single stroke each side	Ft. piston speed each side	Total g.p.m. both pistons		
Steam cylin- der	Pump cylin- der							
3	2	3	.04	72	18	5.76	83	Sledge
4½	2¾	4	.10	66	22	13.2	190	Sabot
5½	3½	5	.208	58	24	24.13	350	Sin
6	4	6	.33	52	26	34.32	497	Silk
7½	5	6	.51	52	26	53.04	768	Shake
7½	5	10	.85	46	38	78.2	1,133	Sharkey
8	5	12	1.02	40	40	81.6	1,182	Persist
10	6	12	1.47	40	40	117.6	1,704	Parable
12	7	12	2.00	40	40	160.0	2,318	Pedigree
12	8½	12	2.95	40	40	236.0	3,420	Peddle
14	8½	12	2.95	40	40	236.0	3,420	Pervert
14	10	12	4.08	40	40	326.4	4,730	Peg
16	10	12	4.08	40	40	326.4	4,730	Pistol
16	10	18	6.12	40	60	489.6	7,095	Pester
16	12	12	5.87	40	40	469.6	6,805	Pink
16	12	18	8.81	40	60	704.8	10,214	Pastry

FOR LIGHT HEADS—LOW SERVICE

3	2 3/4	3	.08	100	25	16.0	.....	Pigmy
4 1/2	3 3/4	4	.19	90	30	34.2	.....	Pony
4 1/2	4	4	.22	90	30	39.6	.....	Pontoon
5 1/2	4 3/4	5	.38	82	34	62.32	.....	Shadow
5 1/2	5	5	.42	82	34	68.88	.....	Shade
6	5 3/4	6	.67	72	36	96.48	.....	Sandal
7 1/2	6	10	1.22	63	52	153.72	.....	Sordid
7 1/2	7	10	1.66	63	52	209.16	.....	Spot
6	7 1/2	6	1.14	72	36	164.16	.....	Sentry
7 1/2	7 1/2	10	1.91	63	52	240.66	.....	Spotter
6	8 1/2	6	1.47	72	36	211.68	.....	Sickle
7 1/2	8 1/2	6	1.47	72	36	211.68	.....	Summer
7 1/2	8 1/2	10	2.45	63	52	308.7	.....	Stag
10	8 1/2	12	2.95	54	54	318.6	.....	Preside
8	10	12	4.08	54	54	440.64	.....	Poverty
10	10	12	4.08	54	54	440.64	.....	Proof
12	10	12	4.08	54	54	440.64	.....	Pulpit
10	12	12	5.87	54	54	633.96	.....	Profile
12	12	12	5.87	54	54	633.96	.....	Puppy
14	12	12	5.87	54	54	633.96	.....	Pungent
12	14	12	8.00	54	54	864.00	.....	Punish
14	14	12	8.00	54	54	864.00	.....	Purge
14	14	18	12.00	54	81	1,296.00	.....	Puritan
14	16	18	15.66	54	81	1,691.3	.....	Purpose
16	16	18	15.66	54	81	1,691.3	.....	Pursue

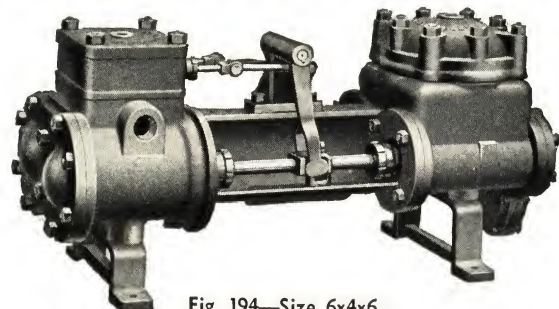


Fig. 194—Size 6x4x6

Pumps in sizes 10x6x12 and smaller are of the type shown in Fig. 194 above, with steam cylinders and center pieces cast in one piece. Stuffing boxes are of the brass screw type.

WARREN VERTICAL DUPLEX PISTON PUMPS

For Boiler Feed or Pressure Service . . . Tank or Light Pressure

These pumps are particularly desirable for service where there is a preference for a duplex piston pump, but where space limitations demand the use of a vertical pump in place of the horizontal type.

As regularly furnished, they are fully brass fitted. Pump end liners, pistons, valve seats, stems, springs, guards and guard nuts are all of brass. Piston rods are solid rolled bronze, except where of the divided type; pump end rods are then made of rolled bronze and the steam end rods of steel, joined by heavy cross heads and caps of cast steel.

Steam pistons are of the solid type with snap rings. Steam cylinders will be lagged with magnesia and covered with planished iron, held by polished brass bands, at extra cost.

Hard or medium rubber pump valves are standard, but at slight extra cost, cast brass disc or phosphor bronze multi-disc type valves may be had. Steam valves on small sizes have adjustments inside of steam chests. On the larger sizes, adjustments are made outside through means of threaded tappet collars.

Can be built to operate on super-heated steam.

FOR BOILER FEED OR PRESSURE SERVICE

Size			Capacity				Boiler H.P. pump will feed	Code word
Steam cylinder	Pump cylinder	Stroke	Gals. per stroke each piston	Strokes per minute each piston	Ft. piston speed each piston	Total gals. per min.		
3	2	3	.04	72	18	5.76	83	Vacant
4½	2¾	4	.10	66	22	13.2	190	Vacation
5¼	3½	6	.25	52	26	25.9	375	Vacaw
5¾	3¾	8	.332	45	30	29.9	432	Vaccinate
5¾	4	8	.435	45	30	39.1	567	Vagabond
7½	5	8	.68	45	30	61.2	886	Vagalite
8	5	12	1.02	40	40	81.6	1,182	Vagient
9	6	12	1.47	40	40	117.6	1,704	Vagrant
10	6	12	1.47	40	40	117.6	1,704	Vague
10	7	12	2.00	40	40	160.0	2,318	Vail
12	7	12	2.00	40	40	160.0	2,318	Vain
12	8	12	2.61	40	40	208.8	3,026	Vaga
12	8½	12	2.95	40	40	236.0	3,420	Vagary
14	8½	12	2.95	40	40	236.0	3,420	Vakeel

Heavy Pressure—Individual Pot, Piston Steam Valves, Type XL

6	6	6	.73	52	26	76.3	.....	XLFBFA
7½	6	10	1.22	46	38	111.6	.....	XLFBFB
9	6	12	1.47	40	40	117.6	.....	XLFBFC
12	8½	12	2.95	40	40	236.0	.....	XLFBFD
14	11	12	4.93	40	40	394.4	.....	XLFBFE

FOR TANK OR LIGHT SERVICE

3	2¾	3	.08	100	25	16.0	.....	Vamose
4½	4	4	.22	90	30	39.6	.....	Vamp
5¼	5	5	.42	82	34	68.9	.....	Vampire
6	6	6	.73	72	36	115.2	.....	Van
7½	6	12	1.47	54	54	158.8	.....	Vanadium
8	7	12	2.0	54	54	216.0	.....	Vandal
8	8½	12	2.95	54	54	318.4	.....	Vane
10	8½	12	2.95	54	54	318.4	.....	Vanesa
10	10	12	4.08	54	54	440.6	.....	Vanilla
12	10	12	4.08	54	54	440.6	.....	Vanish
10	12	12	5.87	54	54	633.9	.....	Vanity
12	12	12	5.87	54	54	633.9	.....	Vanitone
12	14	12	8.00	54	54	864.0	.....	Vantage

Note: When writing for information, please give data as outlined on page 9 under the heading "Essential Information Needed."

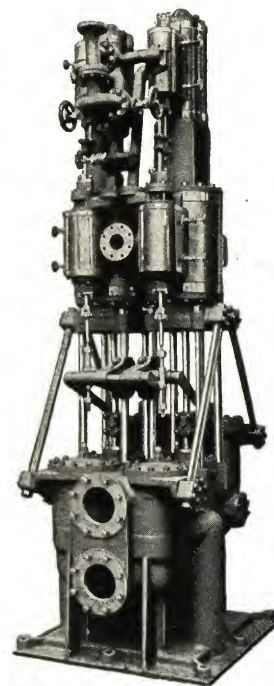


Fig. 309
Size 8x14x10x18
Vertical Compound
Duplex Pump

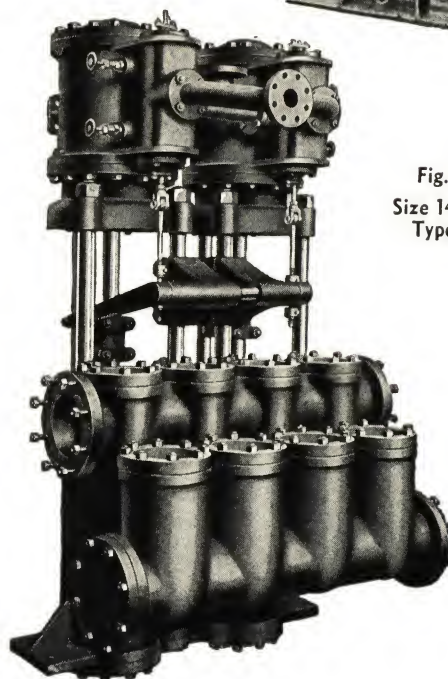


Fig. 313
Size 14x11x12
Type XL

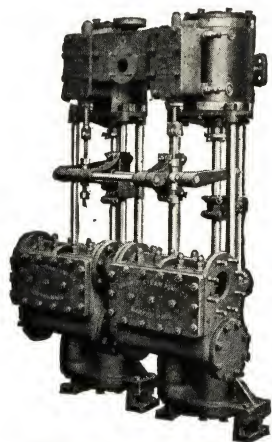


Fig. 184—Size 10x8½x12

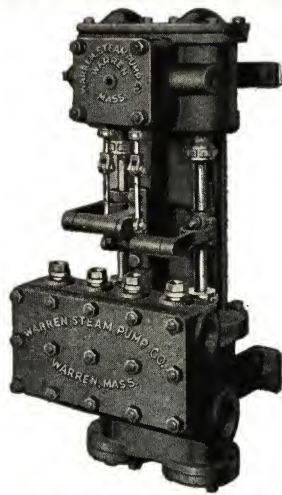


Fig. 52—Size 4½x2¾x4

WARREN DUPLEX AUTOMATIC PUMPS AND RECEIVERS . . . Piston and Plunger Patterns

In design, materials and workmanship . . . in operating efficiency and economy . . . Warren Duplex Automatic Pumps and Receivers fully comply with the Warren standard.

They are used extensively in feeding to boilers the condensation from heating coils, traps, drying kilns, etc., because, designed for the purpose, they bring the condensate into the boiler without the loss of more than a small number of heat units.

As the water rises in the receiver, a float-actuated valve of the balanced-piston type admits steam to the pump, causing it to draw some of the condensate from the receiver. This valve and float mechanism automatically regulates the speed of the pump or stops it when the returns cease to flow into the

receiver. The float, rigidly supported, is on the inside of the receiver and is so arranged that any leakage or accumulation of moisture in same is automatically drawn off to the outside through a hollow shaft to which the regulating lever is attached.

The entire apparatus is mounted on a substantial base, with the receiving unit set high enough upon a pedestal to insure the water level being above the suction valves of the pump at all times.

Warren Duplex Pump and Receiver Units are made in either the piston packed type or the outside end-packed plunger type.

Sizes and particulars of both types are given below.

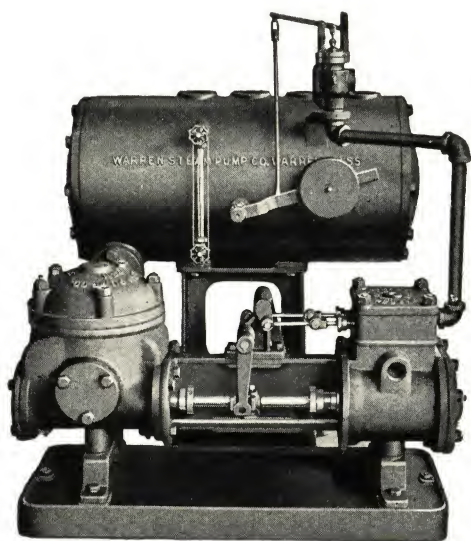


Fig. 176—Size 6x4x6
Duplex Piston Pump and Receiver

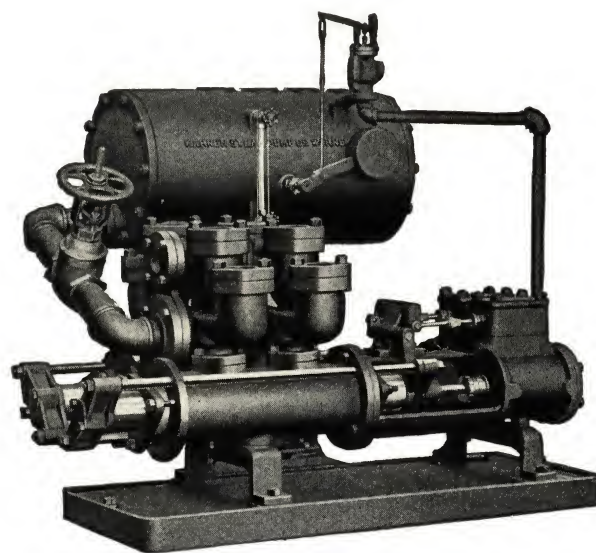


Fig. 188—Size 6x4x6
Duplex Plunger Pump and Receiver

DUPLEX PISTON PUMPS AND RECEIVERS

Size pump	Size receiver	Strokes per side per minute	Gallons per minute	Sq. ft. direct radiation drained	Space occupied, inches			Code word
					Length	Width	Height	
3 x 2 x 3	A	36	2.88	4,320	28	26	32	Roadbed
4½ x 2¾ x 4	B	33	6.6	9,900	33	30	40	Roadway
5¼ x 3½ x 5	C	29	12.06	18,000	42	37	46	Rocky
6 x 4 x 6	D	26	17.16	25,700	45	38	48	Roll
7½ x 5 x 6	E	26	26.5	39,750	60	36¼	55	Rollick
7½ x 5 x 10	F	23	39.1	58,650	66	36¼	55	Rolling

DUPLEX PLUNGER PUMPS AND RECEIVERS

5¼ x 3½ x 5	C	29	12.06	18,000	59	37½	55	Rope
6 x 4 x 6	D	26	17.16	25,700	68½	46½	55	Rose
7½ x 5 x 6	E	26	26.5	39,750	72	46½	55	Rotator
7½ x 5 x 10	F	23	39.1	58,650	92	54	55	Rotrex

WARREN SINGLE OUTSIDE PACKED PLUNGER PUMPS . . . End and Center-Packed

Designed for use in those plants where a single plunger pump best meets requirements, these pumps differ but slightly in general construction from that of the duplex plunger pumps described on the following page. As in the case of the duplex plunger pumps, in the design and manufacture of the single plunger pumps no effort has been spared to produce a product that will give the maximum of efficient service at a minimum pumping cost per year. They are built to the Warren standard, which is complete assurance that the best of materials and expert workmanship enter into their construction.

These pumps, too, as regularly furnished, are equipped with hard, close-grained gray iron plungers, accurately turned and ground to size, with iron glands. Likewise, where desired, they can be had with plungers of bronze, as well as with gland and throat liners of bronze, at additional cost.

Solid type steam pistons with snap rings are standard. Pump valves of bronze and of the bevel-face, wing poppet type with bronze seats are also

standard, but valve seats of the bar type can be furnished with either hard or medium rubber valves or phosphor bronze valves of the multi-disc type.

Available in both the outside end-packed and outside center-packed types. The outside end-packed types have steel piston rods. The outside center-packed types, however, have solid rolled bronze piston rods where of the one-piece type. Where the rods are of the divided type, the outside center-packed pumps have steam rods of steel and pump rods of rolled bronze, joined by heavy cross heads and caps of cast steel.

Every pump of this class is fitted with the patented Warren "Eclipse" Valve Gear for economy in steam consumption and minimum wear on the valves. This valve gear is described on page 10 under Warren Vertical Single Piston Pumps.

Where desired, steam cylinders will be lagged with magnesia and covered with planished iron held by polished brass bands, at extra cost.

Can be built to operate on super-heated steam.

FOR BOILER FEED OR PRESSURE SERVICE

Outside End-Packed

Size			Capacity					Code word
Steam cylinder	Pump cylinder	Stroke	Gals. per stroke	Strokes per min.	Ft. piston speed	Total gals. per min.	Boiler H.P. pump will feed	
8	5	12	1.02	40	40	40.81	591	Koa
10	6	12	1.47	40	40	58.8	852	Kobold
12	7	12	2.00	40	40	80.0	1,160	Kodak
14	7	12	2.00	40	40	80.0	1,160	Koff
14	7	16	2.66	38	50	101.0	1,465	Kola
14	8	12	2.61	40	40	104.4	1,513	Koodoo
14	8	16	3.49	38	50	132.6	1,920	Kopi
14	8½	12	2.95	40	40	118.0	1,710	Koran
14	8½	16	3.93	38	50	149.4	2,165	Koto

Outside Center-Packed

Steam cylinder	Pump cylinder	Stroke	Gals. per stroke	Strokes per min.	Ft. piston speed	Total gals. per min.	Boiler H.P. pump will feed	Code word
8	5	12	1.02	40	40	40.8	591	Kraal
10	6	12	1.47	40	40	58.8	852	Kraken
12	7	12	2.00	40	40	80.0	1,160	Kremlin
12	8	12	2.61	40	40	104.4	1,513	Kris
14	8½	12	2.95	40	40	118.0	1,710	Krone
14	9	18	4.95	40	60	198.0	2,870	Krypton
14	10	18	6.12	40	60	244.8	3,540	Kuklux
16	10	18	6.12	40	60	244.8	3,540	Kultur
18	10	18	6.12	40	60	244.8	3,540	Kumiss
18	15	18	13.77	40	60	551.0	.....	Kutch
18	15	24	18.36	32	64	588.0	.....	Kyanize

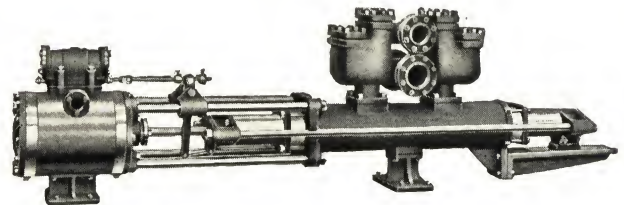


Fig. 192—Size 14x7x16—Outside End-Packed

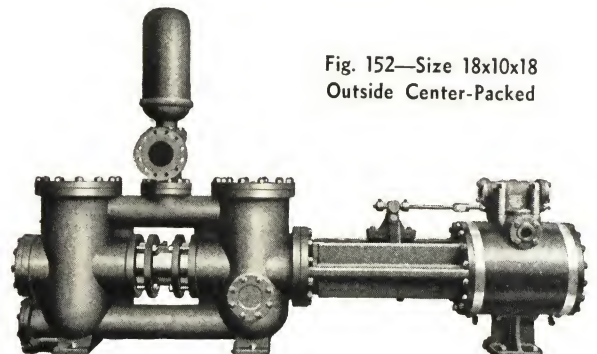


Fig. 152—Size 18x10x18
Outside Center-Packed

Essential Information Needed

The Warren Engineering Department is always glad to co-operate with you to the fullest extent in order to assure you of the utmost efficiency and economy from every pumping installation. When writing for information on the above pumps, or any other of the Warren Reciprocating Pumps shown in this catalogue, we will be able to serve you to the best advantage if you will provide us with detailed data of the type listed on page 9 under Horizontal Single Piston Pumps.

WARREN DUPLEX OUTSIDE PACKED PLUNGER PUMPS . . . End and Center-Packed

Long after the original investment in a pump is forgotten, there is one item that always remains either to plague or to please the purchaser: *pumping cost per year!* In this all-important point, this measure of a pump's true value to the plant, is reflected the care and consideration given to the selection of that pump in the very beginning.

A Warren Duplex Plunger Pump chosen now is a guarantee of pumping satisfaction for the years to come, for, by Warren policy, that is the purpose behind its design and construction.

As regularly furnished, these pumps are fitted with plungers of hard, close-grained gray iron, accurately turned and ground to size, and with iron glands. Pumps, however, can be furnished with gland and throat liners of bronze, as well as plungers of bronze, at additional cost. Steam pistons are of the solid type with snap rings. Steam valves are of the flat-face slide type and on the

smaller pumps have adjustments inside of steam chests. On the larger sizes, adjustments are made outside through means of threaded tappet collars. Pump valves are bronze, of the bevel-face, wing poppet type with bronze seats. If desired, valve seats of the bar type can be furnished with either hard or medium rubber valves, or phosphor bronze valves of the multi-disc type. Steam cylinders will be lagged with magnesia and covered with planished iron held by polished brass bands, at extra cost.

Warren Duplex Plunger Pumps are made in both the outside end-packed and the outside center-packed types. Outside end-packed pumps have piston rods of steel. Outside center-packed pumps have piston rods of solid rolled bronze where of the one-piece type. Where rods are of the divided type, the steam rods are of steel and the pump rods of rolled bronze, joined by heavy cross heads and caps of cast steel.

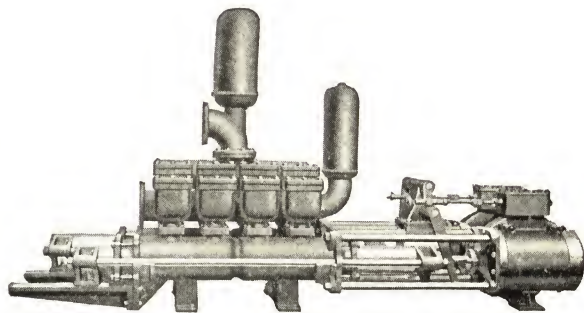


Fig. 100—Size 14x8x18—Pot Valve Type, End-Packed

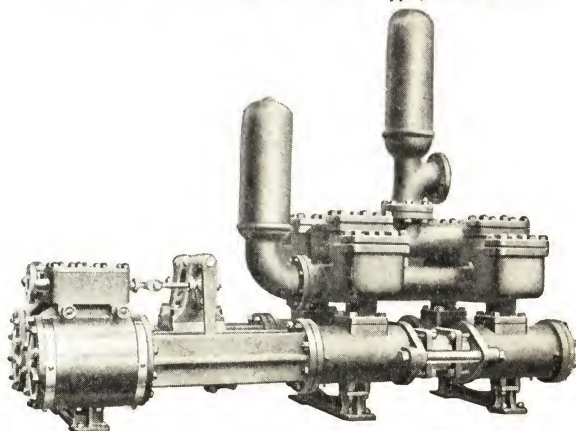


Fig. 123—Size 12x7x12—Pot Valve Type, Center-Packed

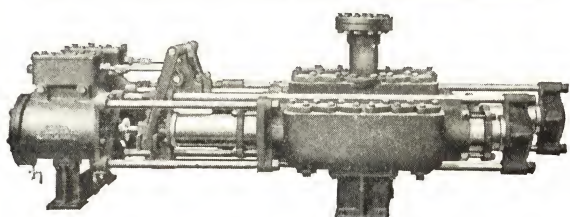


Fig. 75—Size 14x8 1/2 x 12—Solid Barrel Type, End-Packed

FOR BOILER FEED OR PRESSURE SERVICE

Outside End-Packed—Pot Valve Pattern

Size		Stroke	Capacity					Code word
Steam cylinder	Pump cylinder		Gals. per stroke each plunger	Single stroke each plunger	Ft. piston speed each plunger	Total g.p.m. both plungers	Boiler H.P. pump will feed	
5 1/4	3 1/2	5	.208	58	24	24.12	350	Pomadman
6	4	6	.33	52	26	34.32	497	Pomadrepore
7 1/2	5	6	.51	52	26	53.04	768	Pomagnate
7 1/2	5	10	.85	46	38	78.2	1,133	Pomagician
8	5	12	1.02	40	40	81.6	1,182	Pomachete
10	5	12	1.02	40	40	81.6	1,182	Pomacho
10	6	12	1.47	40	40	117.6	1,704	Pomacle
12	6	12	1.47	40	40	117.6	1,704	Pomacro
12	7	12	2.00	40	40	160.0	2,318	Pomactra
14	8	12	2.61	40	40	208.8	3,026	Pomadam
14	8 1/2	12	2.95	40	40	236.0	3,420	Pomade
14	8	18	3.91	40	60	312.8	4,530	Pomean
14	8 1/2	18	4.43	40	60	354.4	5,136	Pomeasure
14	9	18	4.95	40	60	396.0	5,740	Pomedal
14	10	18	6.12	40	60	489.6	7,095	Pomeek

Outside End-Packed—Solid Barrel Pattern

7 1/2	4 1/2	10	.69	46	38	63.5	920	Magic
8	5	12	1.02	40	40	81.6	1,182	Machete
10	6	12	1.47	40	40	117.6	1,704	Macle
12	7	12	2.00	40	40	160.0	2,318	Mactra
14	8	12	2.61	40	40	208.8	3,026	Madam
14	8 1/2	12	2.95	40	40	236.0	3,420	Made
14	8	18	3.91	40	60	312.8	4,530	Mean
14	9	18	4.95	40	60	396.0	5,740	Meek

Outside Center-Packed

7 1/2	4 1/2	10	.69	46	38	63.5	920	Fabian
8	5	10	.85	46	38	78.2	1,133	Fabric
8	5	12	1.02	40	40	81.6	1,182	Facade
10	6	12	1.47	40	40	117.6	1,704	Facet
12	7	12	2.00	40	40	160.0	2,318	Facile
12	8	12	2.61	40	40	208.8	3,026	Faction
14	8	12	2.61	40	40	208.8	3,026	Factor
14	9	18	4.95	40	60	396.0	5,740	Fade
14	10	18	6.12	40	60	489.6	7,095	Fag
16	10	18	6.12	40	60	489.6	7,095	Fallow
18	12	18	8.81	40	60	704.8	10,214	Fame
18	15	18	13.77	40	60	1,102.0		Fancy
24	15	24	18.36	32	64	1,175.0		Fing

Essential Information Needed

When writing for information, please give data as outlined on page 9, under the heading "Essential Information Needed."

